REMARKS

Claims 1-17 were pending. Within the final Office Action, claims 1, 4-9, and 14 were rejected under 35 U.S.C. § 102(b), and claims 2-3, 8, 10-13, and 15-17 were rejected under 35 U.S.C. § 103(a). By the above amendments, claims 1, 7, 10, 14, and 15 have been amended. Accordingly, claims 1-17 are now pending.

ARGUMENT

The Present Invention

The present invention is a high pressure chamber for processing a semiconductor substrate. The high pressure chamber comprises a chamber housing, a platen, and a single mechanical drive mechanism. The chamber housing comprises a first sealing surface. The platen comprises a region for holding the semiconductor substrate and a second sealing surface. The single mechanical drive mechanism couples the platen to the chamber housing.

In operation, the single mechanical drive mechanism separates the platen from the chamber housing for loading and unloading the semiconductor substrate. In further operation, the single mechanical drive mechanism causes the second sealing surface of the platen and the first sealing surface of the chamber housing to contact, thus forming and maintaining a high pressure processing chamber around the semiconductor substrate.

Rejections under 35 U.S.C. § 102

Claims 1, 4-7, 9, and 14

Within the final Office Action, Claims 1, 4-7, 9, and 14 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Number 5,314,574 to Takahasi (Takahashi). Within the final Office Action, it is stated:

> Takahashi discloses a high pressure chamber (Col 1 line 22) for processing semiconductor substrates comprising a first sealing surface (Fig 1-7), a platen for holding semiconductor substrates and a second sealing surface (Fig 1-19), grooves and O-ring seal (Fig 1-21) and a mechanical drive mechanism (Fig 1-24) being a piston driven by a compressible fluid (Col 4 line 50-52) to close and seal the surface to a spacer (Fig 1-20) to form a processing chamber around the substrate.

As described below, Takahashi does not disclose each element recited in claims 1 and 14. Accordingly, Takahashi does not anticipate either claim 1 or claim 14.

Takahashi teaches an apparatus used to remove oxidation film from a semiconductor wafer. In one embodiment, as illustrated in Figure 1, the apparatus comprises a first air cylinder (24) coupled to an intermediate cover (19), and a second air cylinder (10) coupled to an open/close cover (6). The apparatus further comprises a loading platform (18) coupled to the intermediate cover (19).

Referring to Figures 1 and 5 of Takahashi, in operation, a wafer W is placed on the loading platform (18), which is then raised by the first air cylinder (24) to form a first seal between a first pair of sealing surfaces, between the loading platform (18) and an annular shoulder (20) of the apparatus. This action forms an intermediate or purge chamber (29), within which a purge gas used in another, later step is introduced. Next, the second air cylinder 10 raises the open/close cover (6) to break a second seal between a second pair of sealing surfaces, between the shoulder 27 and the open/close cover 6. Breaking this second seal forms a processing chamber comprising the purge chamber (29) and a treatment gas atmosphere chamber (14). The wafer W can now be processed in the processing chamber.

After the wafer W has been processed, the open/close cover (6) closes, forming the second seal and thus isolating the wafer W from the treatment gas atmosphere chamber (14). An inert gas is next introduced into the purge chamber (29) to purge any residual treatment gas. [Abstract] Thus, the purge chamber is used to remove exhaust treatment gas before unloading the wafer W; the purge chamber is *not* used to process the wafer W. Takahashi does not mention let alone teach any pressure for the purge gas. Next, the air cylinder 24 lowers the intermediate cover (19) and thus the loading platform (18), breaking the first seal so that the wafer W can be unloaded. Thus, as described above, Takahashi discloses using multiple air cylinders, a first one that forms a purge chamber by making a first seal, and a second one that forms a treatment chamber by breaking a second seal.

Claim 1 of the present invention has been amended to recite a *single* drive mechanism that both "separates the platen from the chamber housing for loading of the semiconductor substrate and further such that in operation . . . causes the second sealing surface of the platen and the first sealing surface of the chamber housing to contact, thus forming and maintaining a high pressure processing chamber around the semiconductor substrate." Claim 1 thus recites a single drive mechanism used to load and unload the chamber, as well as form and maintain the high-pressure processing chamber. In contrast, Takahashi uses two drive mechanisms, one to

load and unload a wafer and another to form a processing chamber. Furthermore, claim 1 recites a structure that forms a processing chamber by contacting a first sealing surface with a second sealing surface. In contrast, Takahashi teaches forming a processing chamber by breaking a seal, by using an air cylinder to move the open/close cover up. Thus, claim 1 recites structure not found in Takahashi.

Claim 14 has been amended to similarly recite a single drive mechanism that "separates the platen from the chamber housing for loading the semiconductor substrate" and also "causes the means for sealing, the platen, and the chamber housing to form and maintain a high pressure processing chamber around the semiconductor substrate." As in claim 1, claim 14 recites a single drive mechanism not found in Takahashi. Thus, for at least this reason, claim 14 is allowable over Takahashi.

Because Takahashi does not disclose each element recited in either claim 1 or claim 14, Takahashi does not anticipate either claim 1 or claim 14. Furthermore, because claims 4-7 and 9 depend from claim 1, they are allowable as depending from an allowable base claim. We respectfully request that the rejection under 35 U.S.C. § 102(b) be withdrawn.

Claims 1, 4-5, 7-9, and 14

Within the final Office Action, Claims 1, 4-5, 7-9, and 14 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Number 5,979,306 to Fujikawa *et al.* (Fujikawa I). Within the final Office Action it is stated:

> Fujikawa et al disclose a high pressure chamber for processing semiconductor substrates comprising a first sealing surface (Fig 2-5 upper sealing surface), a platen for holding semiconductor substrates and a second sealing surface (Fig 2-5 lower sealing surface), grooves and O-ring seal (Fig 2-9) and a mechanical drive mechanism (Fig 1-24) being a piston driven by a compressible fluid (Fig 6-103) and a non compressible fluid (Fig 6-102 and Col 1-line 64-67 and Col 2-line 46-53) and to close and seal the surface to form a processing chamber around the substrate.

As described below, Fujikawa I does not teach each element recited in either claim 1 or claim 14. Accordingly, Fujikawa I does not anticipate either claim 1 or claim 14.

Referring to Figure 2, Fujikawa I teaches a high-pressure gas processing apparatus that can be used to process devices such as silicon wafers. Fujikawa I teaches a high-pressure vessel that has an upper member (2) and a lower member (3), which when brought together form a

processing space (e.g., col. 5, lines 31-34); a raising and lowering actuator (11) that moves the upper and lower members together for loading a wafer into the vessel and apart for unloading the wafer from the vessel (e.g., col. 5, lines 48-53; Figure 2); a seal ring (9) for sealing the vessel so that gas does not escape from the processing space during processing; and "a pressure rum [sic] 18 having a gas inlet port 18A which is [a] pressing means" (col. 6, lines 1-2).

In operation, a wafer is loaded into the vessel. Next, the actuator 11 is used to move the upper member against the lower member to form the processing space. (E.g., col. 5, lines 48-53; Figure 2). To maintain a seal during processing, in one embodiment, Fujikawa I teaches using the "gas pressure ram 18 for regularly closely fitting the upper member 2 to the lower member 3" (col. 6, lines 32-34). Fujikawa I explains the use of the pressing means further, at column 6, lines 44-51:

> According to such a design, the vessel 1 formed of the upper and lower members 2,3 is regularly kept in the state where the both [sic] are closely fitted at the parting plane as long as the gas pressure is supplied, and the high-pressure gas in the high-pressure gas processing space 5 can be prevented from being leaked out through the parting plane of both the members by the synergistic effect of the sealing effect of the resin-made seal ring 9 which is the elastic body.

Fujikawa I ostensibly uses this configuration to achieve a design goal--it can use one pressure and thus one gas source for the pressing means and as the processing gas in the processing space, a design that demands that the surface area of the pressing means be larger than that of the platen. (*Id.*, col. 4, lines 27-42; col. 6, lines 33-43) Such a design, however, requires a separate actuator to move the chamber elements apart and together, for loading and unloading a wafer, and a separate means to maintain the seal.

Fujikawa I does not teach each element recited in claim 1. For example, as discussed above in relation to Takahashi, claim 1 of the present invention has been amended to recite a *single* drive mechanism that both "separates the platen from the housing for loading of the semiconductor substrate and further such that in operation . . . causes the second sealing surface of the platen and the first sealing surface of the chamber housing to contact, thus forming and maintaining a high pressure processing chamber around the semiconductor substrate." Fujikawa I does not teach such a structure.

Similarly, claim 14 has been amended to recite a "single mechanical drive mechanism [that] causes the means for sealing, the platen, and the chamber housing to form and maintain a high pressure processing chamber around the semiconductor substrate."

Because Fujikawa I does not teach each element recited in either claim 1 or claim 14, Fujikawa I does not anticipate either claim 1 or claim 14. Furthermore, because claims 4-5 and 7-9 depend from claim 1, they are allowable as depending from an allowable base claim. We respectfully request that the rejection under 35 U.S.C. § 102(b) be withdrawn.

Rejections under 35 U.S.C. § 103

Claims 2-3

Within the final Office Action, Claims 2-3 were rejected under 35 U.S.C. § 103 as being unpatentable over Takahashi in view of U.S. Patent Number 5,798,126 to Fujikawa *et al.* ("Fujikawa II"). Within the final Office Action it is stated:

> Takahashi discloses [a] seal on the spacer but not on the first surface (on the chamber housing).
> Fujikawa et al teach a high-pressure chamber with several ways of sealing and disclose (Fig 7) two surfaces sealing to each other through spacer (27) having o-ring grooves and seals in both surfaces.
> Therefore it would have been obvious for one with ordinary skill in the art at the time [the] invention was made to have a groove and seal in [the] first surface so as to keep the seal clean.

This rejection is now moot because, as described above, claim 1 is allowable. Accordingly, because claims 2-3 depend from claim 1, claims 2-3 are also allowable as depending from an allowable base claim.

Claims 8 and 10-12

Within the final Office Action, claims 8 and 10-12 were rejected under 35 U.S.C. § 103 as being unpatentable over Takahashi in view of U.S. Patent Number 5,898,727 to Fujikawa *et al.* Within the final Office Action it is stated:

> Takahashi discloses an air (compressible) cylinder but does not disclose the possibility of [a] hydraulic (incompressible) cylinder or motorized actuator.
> Fujikawa et al disclose other driving means for a linear actuator, like hydraulic and motorized (Col 6 line 45-56). It is well known that a motorized actuator uses a screw for changing rotary motion to a linear one.

> Therefore it would have been obvious for one with ordinary skill in the art at the time [the] invention was made to use hydraulic or motorized actuator with a screw so as to have fast opening and closing operation without jitters.

This rejection is now moot because, as described above, claim 1 is allowable. Accordingly, because claims 8 and 10-12 depend from claim 1, claims 8 and 10-12 are allowable as depending from an allowable base claim.

Claim 13

Within the final Office Action, claim 13 is rejected under 35 U.S.C. § 103 as being unpatentable over Takahashi in view of U.S. Patent Number 6,067,728 to Farmer *et al.* Within the final Office Action it is stated:

> Takahashi does not disclose a clamp to keep the two parts of the high-pressure chamber sealed together during processing.
> Farmer et al disclose clamps on both sides of [a] high-pressure chamber (Fig 30-520 and 550 and Col 6 line 31-34).
> Therefore it would have been obvious for one with ordinary skill at the time the invention was made to sue a clamp to hold the two parts hermetically sealed during processing at high pressure.

This rejection is now moot because, as described above, claim 1 is allowable. Accordingly, because claim 13 depends from claim 1, it too is allowable as depending from an allowable base claim.

Claims 15-17

Within the final Office Action, claims 15-17 were rejected under 35 U.S.C. § 103 as being unpatentable over Takahashi in view of U.S. Patent Number 6,077,053 to Fujikawa *et al.* ("Fujikawa IV"). Within the final Office Action it is stated:

> Takahashi discloses a pressure chamber frame (Fig 1 25, 17 and 24 combined), an air cylinder (24) having a piston coupled to the pressure chamber frame, a sealing plate (23) and a platen coupled to the piston neck.
> Takahashi does not expressly disclose the inside of the fluid cylinder to show [a] first fluid cavity defined by the piston body attached to the frame and the piston and the second fluid cavity defined by the piston neck and [the] pressure chamber frame.
> It is inherent and obvious to have two fluid cavities in a fluid cylinder, one on the side of the neck and the other on the other side of the piston to be used to move

the piston one way or the other using differential pressure. As an example, Fujikawa [IV] discloses this in a gas compressor using pistons (Fig 2 – region H being second cavity and behind R5 being first cavity).
Regarding claim 16 and 17 as Takahashi discloses that the apparatus could be used both at high pressure or normal pressure (Col 1 line 22) it would be obvious to be able to use this chamber for either supercritical processing or non-supercritical processing.

Claim 15 has been amended to recite a "piston body [that] can be moved so that the first and second sealing surfaces contact to form and maintain a high pressure processing chamber, and in further operation the piston body can be moved so that the first and second sealing surfaces do not contact, thereby allowing the semiconductor substrate to be loaded into and unloaded from the pressure chamber frame." As described above, Takahashi does not teach this structure. Accordingly, the combination of Takahashi and Fujikawa IV does not teach the structure of the amended claim 15, and claim 15 is allowable in light of the combination of Takahashi and Fujikawa IV. Moreover, because claims 16 and 17 depend from claim 15, they too are allowable as depending from an allowable base claim.

CONCLUSION

For the reasons given above, the Applicants respectfully submit that claims 1-17 are distinguishable over the cited references and are in condition for allowance. Allowance at an early date would be appreciated. If the Examiner has any questions or comments, he is encouraged to call the undersigned at (408) 530-9700 so that any outstanding issues can be expeditiously resolved.

Respectfully submitted,
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